Electronic Supplementary Material (ESI) for Dalton Transactions.

Electronic Supplementary Information

Nanomolar level selective dual channel sensing of Cu^{2+} and CN^- from aqueous medium by an opto-electronic chemoreceptor

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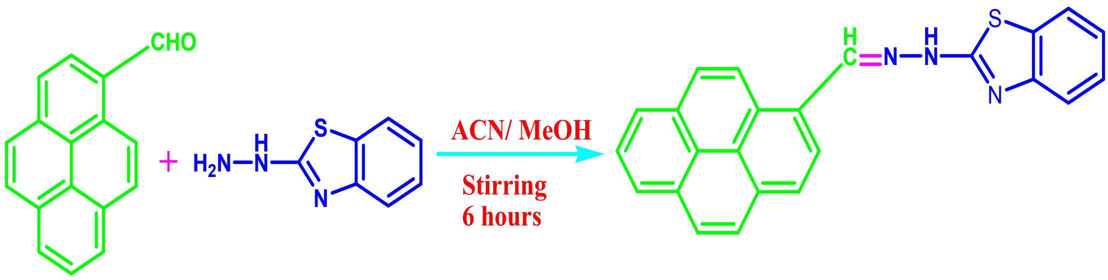
1. Experimental

Synthesis of TyM



Scheme S1 Synthesis of chemoreceptor **TyM.**

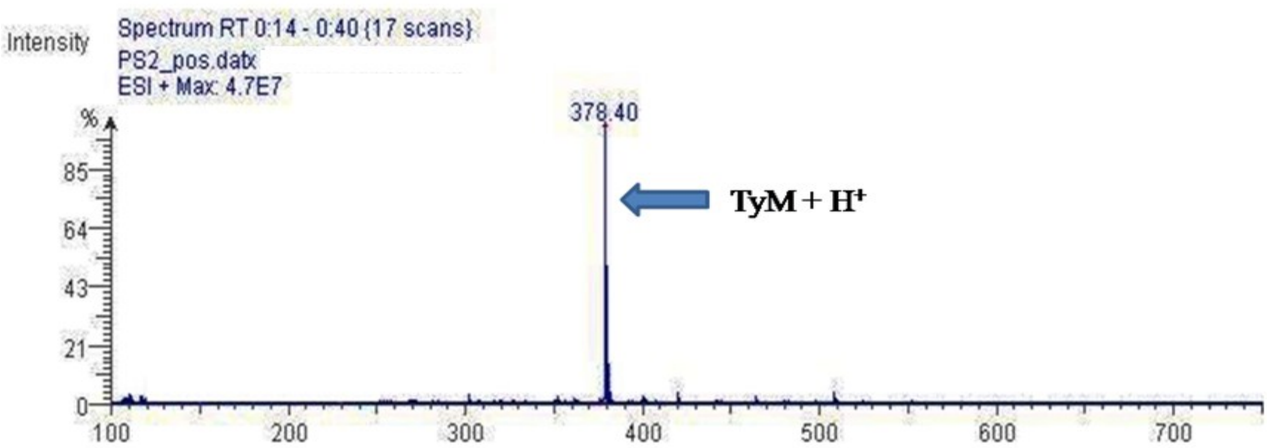


Fig. S1 ESI-MS of **TyM** in MeCN.

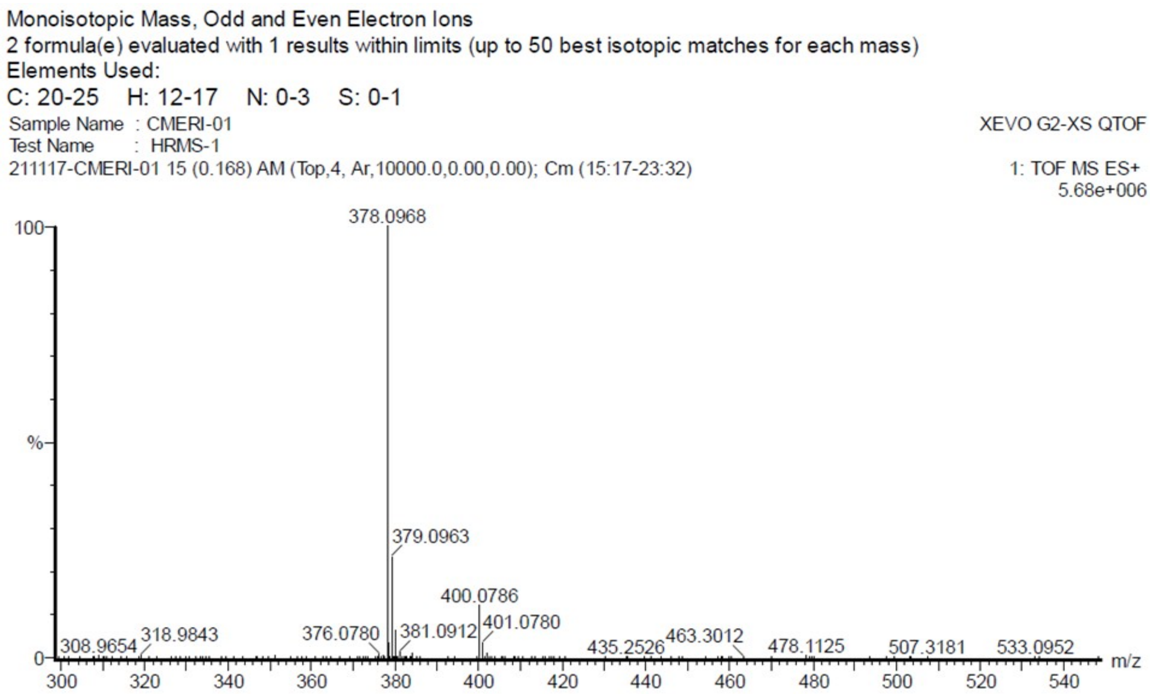


Fig. S2 HRMS of **TyM** in MeCN

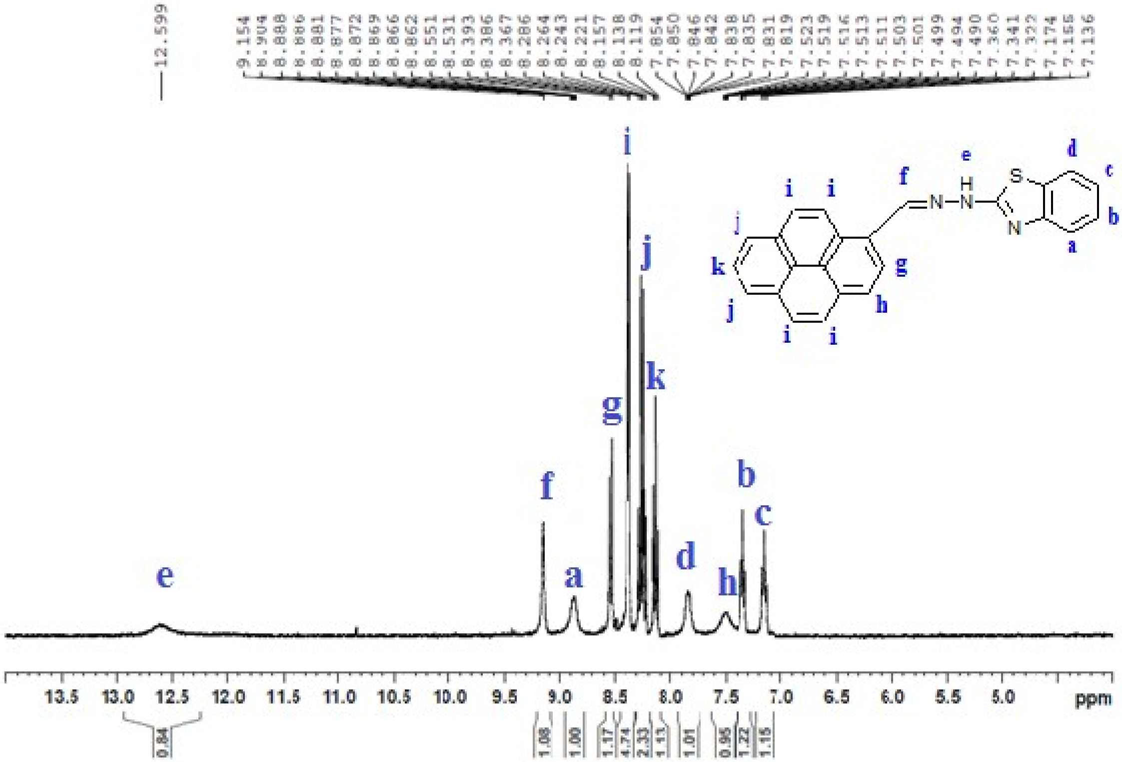


Fig. S3 ^{1}H-NMR of **TyM** in DMSO-d_6.

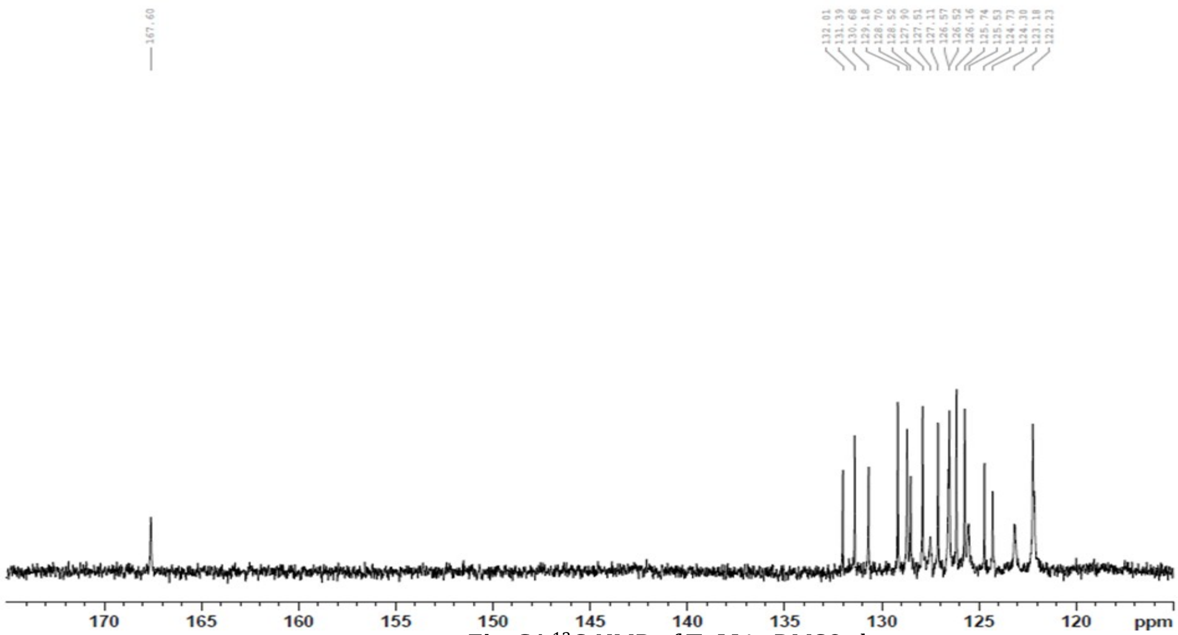
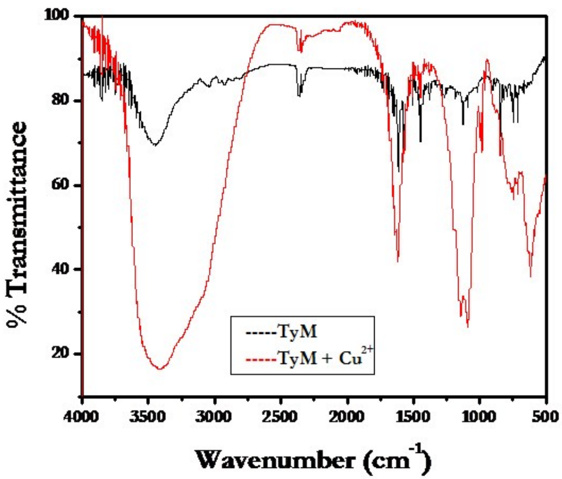


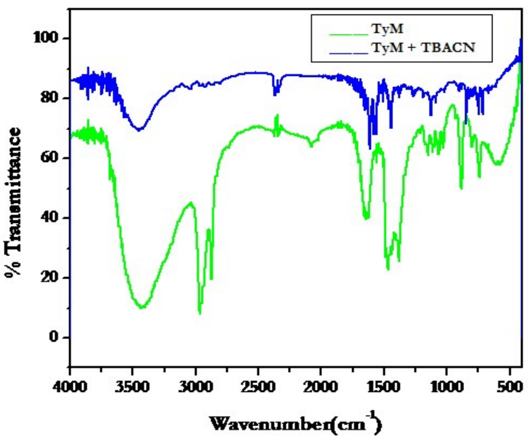
Fig. S4 ^{13}C-NMR of **TyM** in DMSO-d_6

IR Studies:

The FTIR spectrum of the chemoreceptor **TyM**, **TyM•••**Cu^{2+} and **TyM•••**CN^{-} complex were recorded in KBr disks. The existence of the peak at 3440 cm^{-1} indicated the presence of secondary amine functional group in the chemoreceptor molecule. The peak at 1630 cm^{-1} corresponds to the aldimine bond. This in turn affirms the formation of Schiff base between the aromatic aldehyde and hydrazine (herein 1-pyrene-carboxaldehyde and 2-hydrazino benzothiazole).When trace amount of Cu^{2+} was added to the chemoreceptor **TyM**, the peak at 1630 cm^{-1}was shifted to a lower value of 1600 cm^{-1} which confirms that the aldimine nitrogen atom present in the **TyM** molecule is involved in coordination with Cu^{2+}. On the contrary the lone pair of nitrogen in the -NH group present in the chemoreceptor molecule is getting delocalised after interaction with CN^{-} so the N-H bonded electron will be drifted towards nitrogen and therefore the -NH bond will be weak and broadened in nature.. This clearly suggests that CN^{-} interacts with NH proton of the secondary amine present in **TyM**. In addition there arises a new peak in the region of 2800cm^{-1} which corresponds to the formation of H•••CN.[1] The peaks from 1600 cm^{-1} to



500 cm^{-1} also become flattened, which clearly implies an enhanced electronic distribution within the skeleton system with the addition of CN^- ion (Fig. S5).



(a) **(b)**

Fig. S5 FTIR spectra **(a) TyM** + Cu^{2+} **(b) TyM** + CN^-.

Benesi-Hildebrand (B-H) Equation and Plot:

The association constant of a complex formed in between the chemoreceptor and the incoming targeted analytes has been determined from the following complex equilibrium.

$$L + mX^{n-} \longleftrightarrow (X_mL)^{mn-}$$

$$K = \frac{[(XmL)]^{mn^-}}{[L][X^{n^-}]^m}$$

For 1:1 type complex formation with m=1 the Benesi-Hildebrand relation is adopted which can be expressed in terms of optical density (A) as follows:

$$A = \frac{A_0 + A_1K[X^{n-}]}{1+K[X^{n-}]}$$

Or,

$$\frac{1}{A - A_0} = \frac{1}{(A_1 - A_0)} + \frac{1}{(A_1 - A_0)K[X^{n-}]}$$

Where $[X^{n-}]$, [L] and $[(X_mL)^{mn-}]$ are the concentration of the added targeted analyte, chemoreceptor and complexation between the analyte and the chemoreceptor, respectively. A_o, A and A_1 indicates the optical density or absorbance at a particular wavelength of **TyM** prior to the addition of the analyte, absorbance after adding the analyte at every successive step and finally excess amount of the added analyte, respectively. The binding constant or association constant K (M^{-1}) is determined from the ratio of intercept and slope of Benesi-Hildebrand plot of optical density. As depicted in the following In the Benesi-Hildebrand (B-H) plot of 1/[A-A_0] *vs* 1/[CN^-] for the titration of the chemoreceptor **TyM** and CN^- provides a straight line (best fitted), indicating a 1:1 type complex formation with association constant K = 0.98 x 10^6 M^{-1} (Fig. S6)

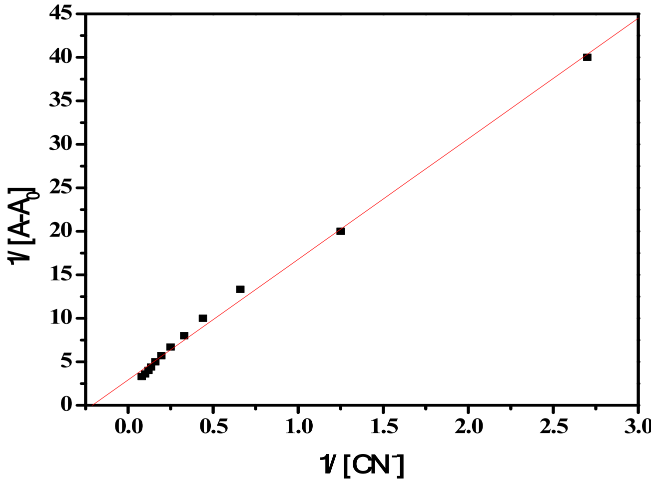


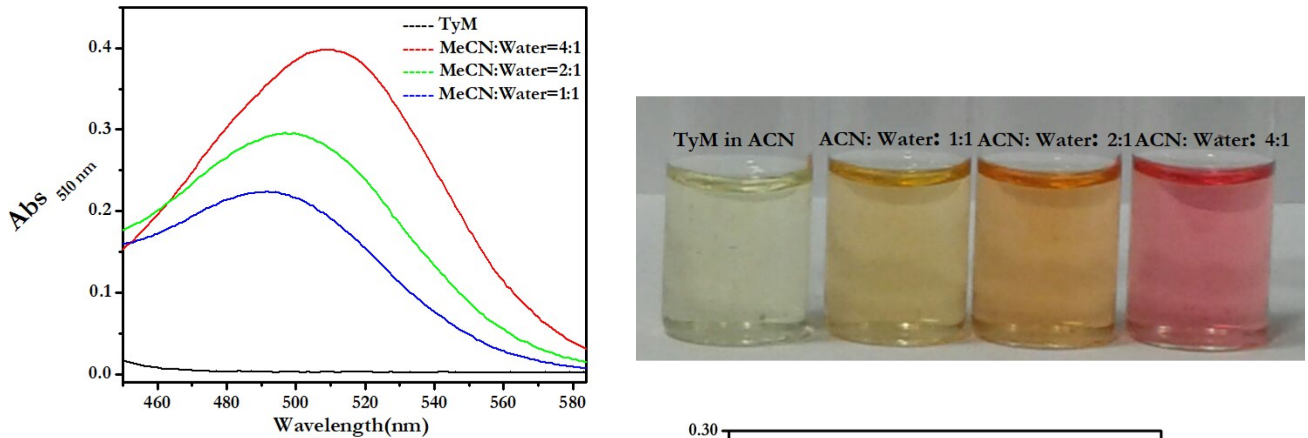
Fig. S6 B-H plot of chemoreceptor **TyM** *vs.* CN^-.

Colorimetric response and Optical performance:

The colorimetric response and optic performances of the chemoreceptor has been investigated in presence of varying solvent mixture.

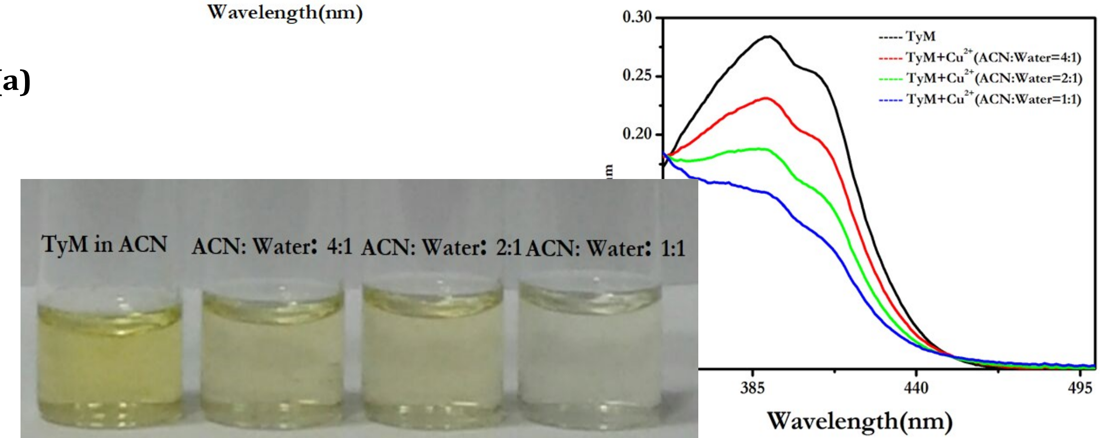
The UV-Vis study of the chemoreceptor in presence of targeted analyte (*i.e.;* Cu^{2+} and CN^-) in varying solvent mixture has been carried out. In case of CN^- the absorbance at 510 nm has been monitored carefully. The figure indicates that the sensing is possible even in presence of water which undoubtedly establishes the superiority of the chemoreceptor. In semi aqueous medium [ACN:Water (4:1, *v/v*)] the detection shows red coloration owing to the strong adduct formation which is also noticed in case of ACN:Water (1:1, *v/v*) solvent mixture. Indeed the affinity of the developed chemoreceptor towards CN^- is established.

The detection of Cu^{2+} reported herein no way encounters any interference from the existence of water since the chemoreceptor designed exhibits its proclivity towards Cu^{2+} and the luminescence is although enhanced in presence of water however the individual detection occurs at completely different spectroscopic energy levels clearly stating that the detection of Cu^{2+} is not a consequence of existence of aqueous medium in the sample.



(a)

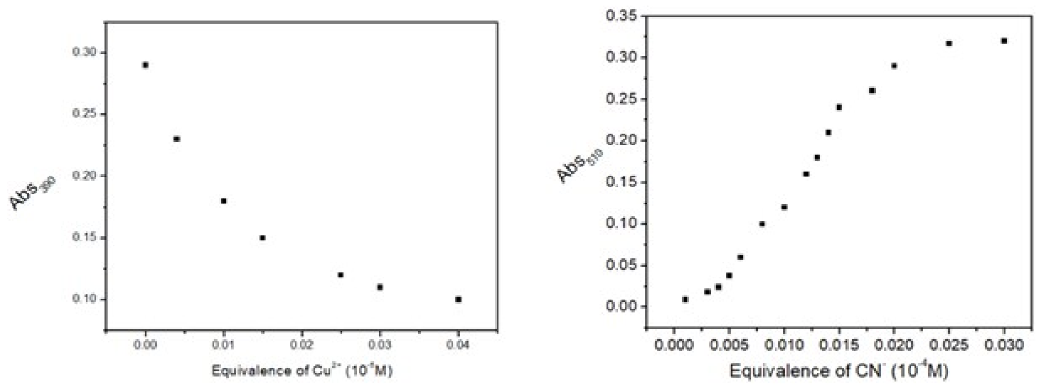
(b)



(c) **(d)**

Fig. ***S7*** **(a)** UV-Vis absorption changes of **TyM** with gradual addition of CN^- (1 x 10^{-4}M) in varying proportion of CH_3CN and H_2O. **(b)** Colorimetric changes of TyM with CN^- in varying proportion of CH_3CN and H_2O. **(c)** UV-Vis absorption changes of **TyM** with gradual addition of Cu^{2+} (1 x 10^{-4}M) in varying proportion of CH_3CN and H_2O. **(d)** Colorimetric changes of TyM with Cu^{2+} in varying proportion of CH_3CN and H_2O.

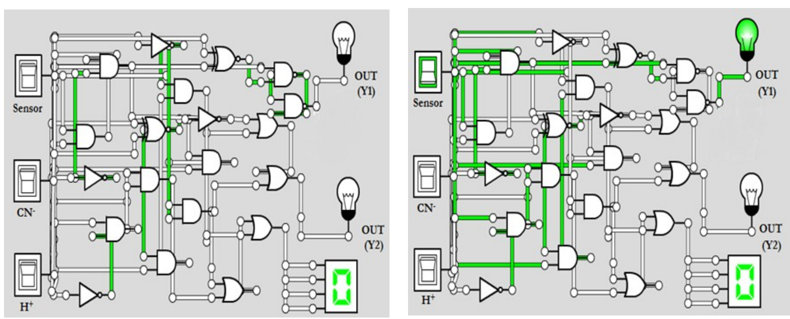
The linearity range of colorimetric response of Cu^{2+} and CN^- is plotted and placed hereby:



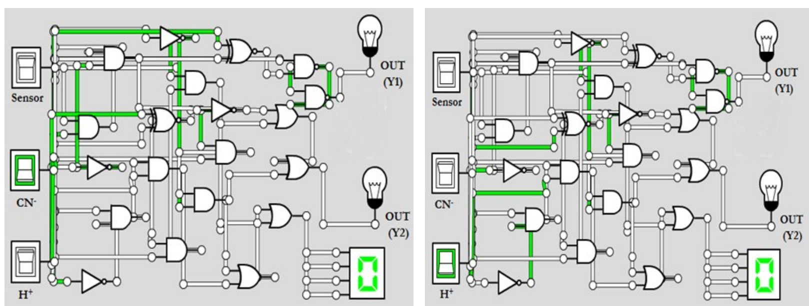
(a) **(b)**

Fig. S8 Linearity range of colorimetric response of **TyM** towards **(a)** Cu^{2+}, **(b)** CN-.

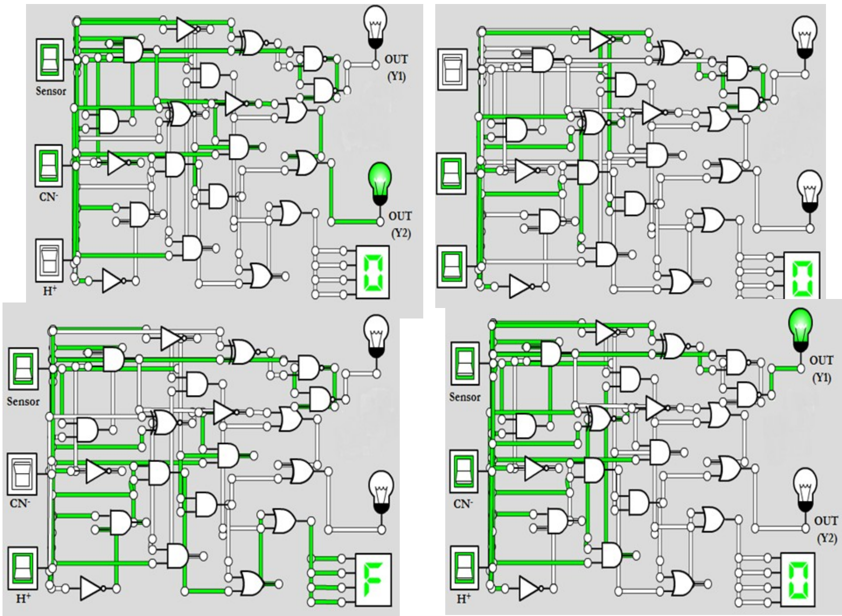
Electronic circuit fabrication based on different logic gates:



In1: In2: In3 :: 0 0 0 **In1: In2: In3 :: 1 0 0**



In1: In2: In3:: 0 1 0 **In1: In2: In3 :: 0 0 1**

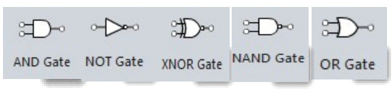


In2: In1:

In1: In3 :: 1 1 0 In2: In3:: 0 1 1

In1: In2: In3:: 1 0 1 **In1: In2: In3:: 1 1 1**

Fig. S9 Fabrication of logic gate with outputs (Y1 and Y2) upon varying inputs AND-NOT-XNOR-NAND-OR logic functions.



Effect of Water:

Upon gradual addition of water to the acetonitrile solution of chemoreceptor **TyM** the luminescence of the bare chemoreceptor **TyM** was enhanced with the simultaneous shift in the emission profile. The initial peak at 485 nm was shifted to 460 nm after addition of water. Pyrene moiety being an aromatic fused hydrophobic ring when encounters water molecules in its surrounding it tends to form an aggregate which consequences in enhancement of the photoluminescence property of the chemoreceptor **TyM** *via* Aggregation Induced Emission Enhancement (AIEE). The effect of water has not been interfering during the detection of Cu^{2+} in the aqueous medium since the response of the chemoreceptor **TyM** towards water as well as Cu^{2+} was at completely different spectroscopic energy. In case of water the fluorescence of the solution was feebly enhanced along with change in spectroscopic wavelength from 485 nm to 460 nm during the increase in the luminescence. On the contrary Cu^{2+} leads to a manifold enhancement in emission accompanied by a transition in luminescence from green to cyan.

From the figure it is quite evident that with increase in percentage of water the emission intensity of the chemoreceptor **TyM** has increased. The trend in the increase of emission intensity follows the order; Water > ACN:Water (1:1, *v/v*) > ACN:Water (2:1, *v/v*) > ACN:Water (4:1, *v/v*) (Fig. S10). The outcome of the fluorometric response is a direct consequence of the varying proportion of water. It is ascertained that with the increase in water exhibit a driving force in alleviation of luminescence of the probe. Herein the peak at 485 nm corresponding to the inherent fluorescence of the chemoreceptor has been shifted to 460 nm after addition of water. Owing to the fact that the fluorophore pyrene moiety being an aromatic fused hydrophobic ring when encounters water molecules in its surrounding it tends to form an aggregate. Furthermore this aggregation consequence in enhancement of photoluminescence property of the chemoreceptor **TyM** *via* aggregation induced emission enhancement (AIEE)[2]. However the addition of water to the chemoreceptor solution doesn't induce any colorimetric change which is also evident from the comparative study with the other cations (Fig. 1 of Main article).

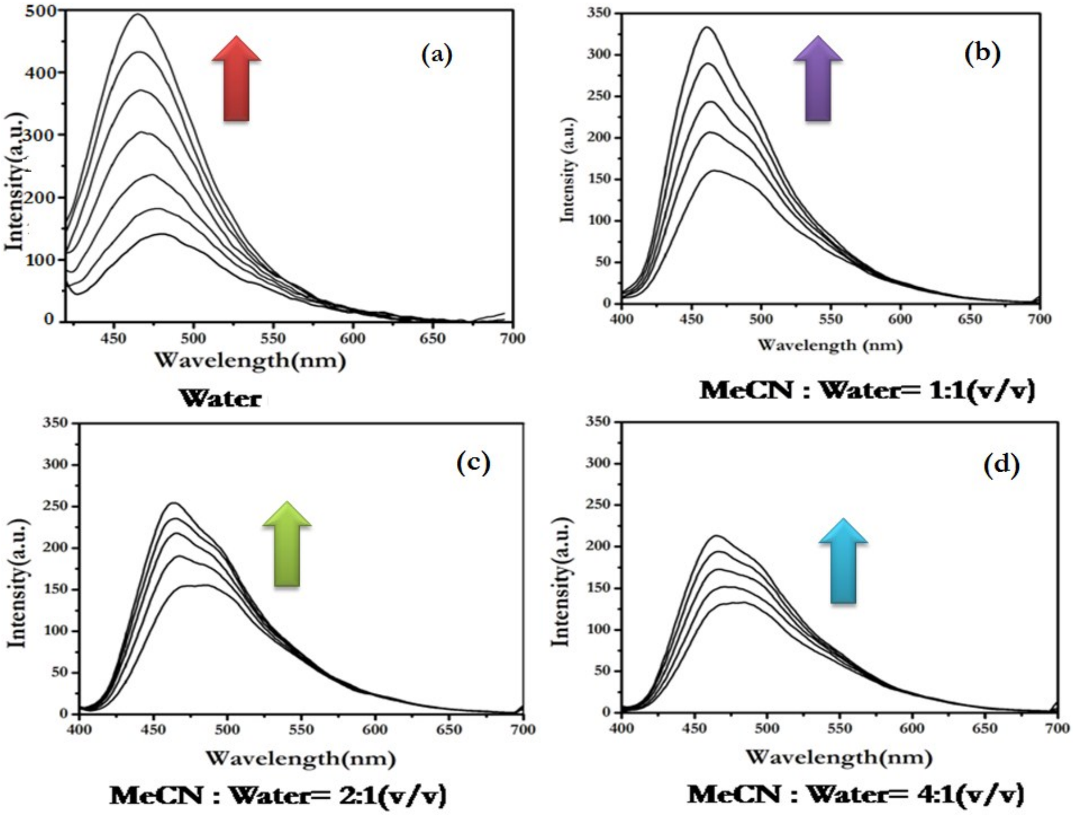
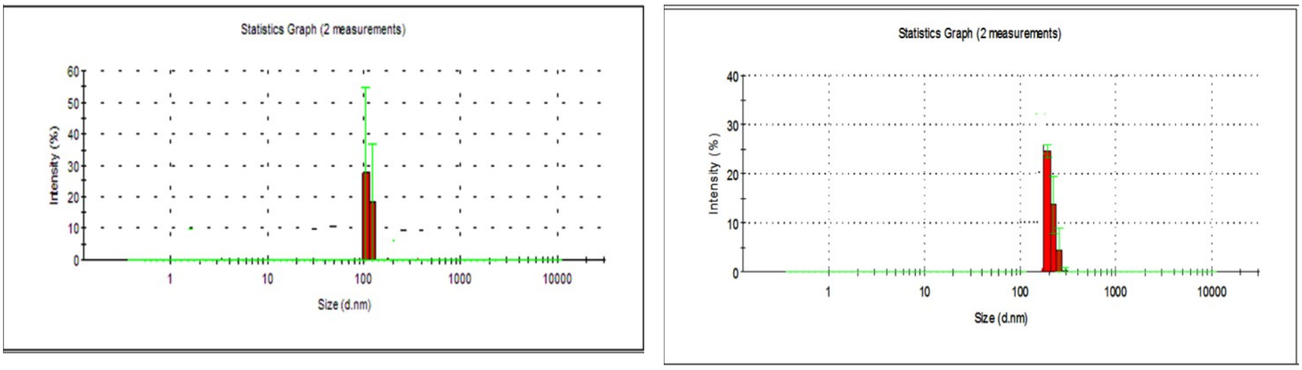


Fig. S10 Fluorescence spectra of TyM in varying proportion of CH_3CN and H_2O. **(a)** Water, **(b)** MeCN : Water= 1:1(*v/v*), **(c)** MeCN : Water= 2:1 (*v/v*), **(d)** MeCN : Water= 4:1(*v/v*)

Evidence in favour of AIEE:

Dynamic light scattering (DLS) is a technique that can be used to determine the size distribution profile of small particles in suspension or polymers in solution. If the system is mono dispersed, there should only be one population, whereas a poly dispersed system would show multiple particle populations. DLS has been executed herein in order to assess the particle size of the sole chemoreceptor **TyM** and the variation in its dimension after interaction with the water. The outcome is in line with the speculation. The initial size of **TyM** is ~ 110nm whereas a substantial enhancement in the size has been observed (~ 340nm) after interaction with water due to the agglomeration of the **TyM** particles in the aqueous environment.

Formation of aggregate of the chemoreceptor molecule in existence of water is truly reflected in its emission properties thus satisfying Aggregation Induced Emission Enhancement (AIEE) phenomenon.



(a) **(b)**

Fig. S11 Particle size determination of **(a) TyM (b) TyM** + H_2O.

The association constant for 2:1 complexation of **TyM** : Cu^{2+} has been determined by employing equation 1:

$$\frac{\alpha^2}{1-\alpha} = \frac{1}{2K_a C_F\,[M]} \quad \text{.................}\ (1)$$

where, C_F is the total concentration of **TyM** in the system and "α" is defined as the ratio between the free chemoreceptor **TyM** and its total concentration. The value "α" has been obtained using equation 2:

$$\alpha = \frac{F - F_0}{F_1 - F_0} \quad \text{............................}\ (2)$$

where F is the fluorescence intensity at 485 nm at any given concentration of the analyte (Cu^{2+} herein), F_1 is the fluorescence intensity at 485 nm in the absence of Cu^{2+}, F_0 is the maxima fluorescence intensity at 485 nm in the presence of Cu^{2+}. The association constant Ka has been evaluated graphically by plotting $\frac{\alpha^2}{1-\alpha}$ against 1/ [Cu^{2+}] and is shown in Fig. S12. The data so obtained has been linearly fitted according to Eq. (1) and the K_a value has been obtained from the slope of the line. The association constant has been evaluated to be 0.1 x 10^5 M^{-2}.

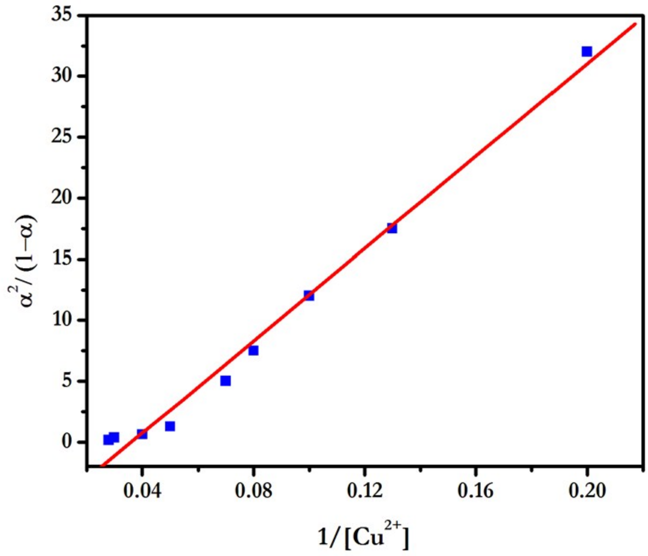


Fig. S12 Association constant determination of chemoreceptor **TyM** *vs.* Cu^{2+}.

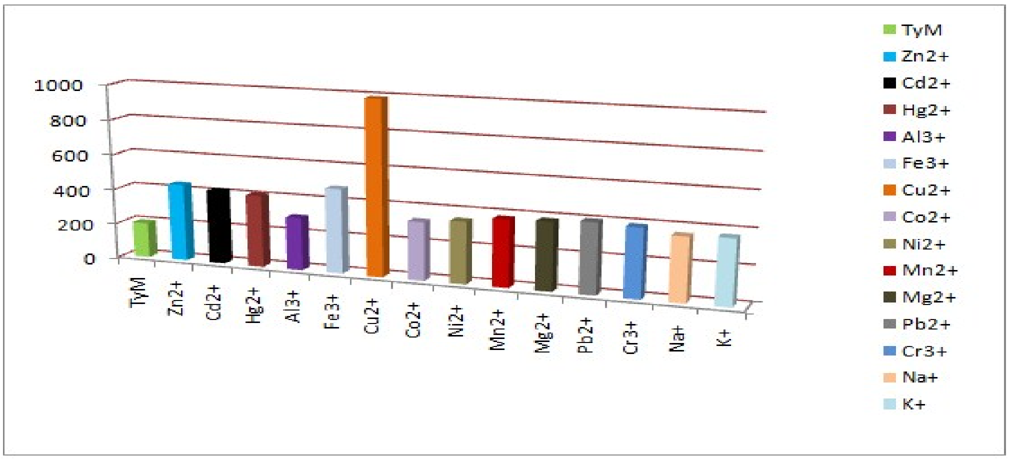
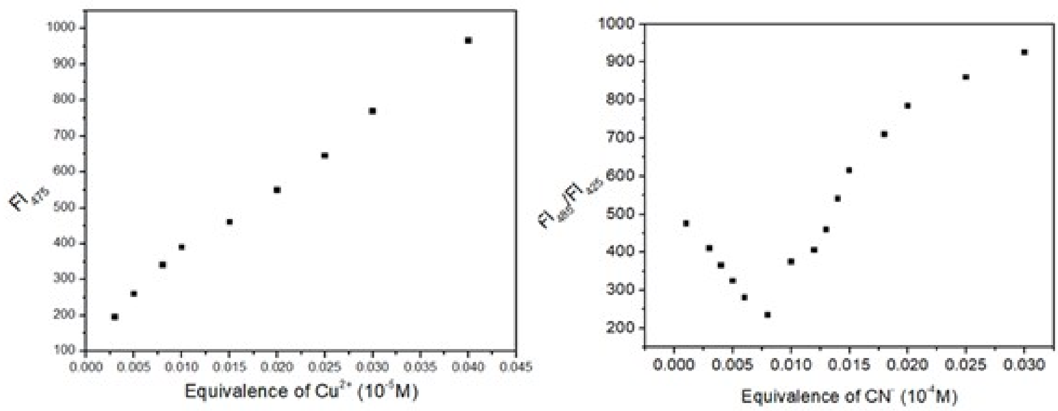


Fig. S13 Comparative study of the chemoreceptor **TyM** in presence of other cations.

The linearity range of fluorometric response of Cu^{2+} and CN^- is plotted and placed hereby:



(a) **(b)**

Fig. S14 Linearity range of fluorescent detection of **TyM** towards **(a)** Cu^{2+}, **(b)** CN^-.

Table S1 – Geometry optimized coordinates of **TyM**.

N	4.449344600	5.760345501	9.688249293
N	4.682333133	5.143017679	10.910655213
C	4.991362570	6.237767416	4.870920921
C	5.324802965	5.677587759	3.615524187
C	4.467962577	7.549194695	4.925886734
C	5.176332801	5.486864911	6.063693211
C	4.123560237	8.104879419	6.160106414
C	5.832645874	4.363256289	3.540683343

C	5.146254788	6.430945989	2.431543286
C	4.843378983	6.078248854	7.315905950
C	5.078011407	5.387877626	8.614569021
C	4.307901209	7.380632628	7.335895626
C	4.293401592	8.285476174	3.744041266
C	5.665578442	4.165531148	5.955084524
C	4.632160546	7.732063191	2.507451598
C	5.993711072	3.617699767	4.712602267
C	6.161640320	3.814636005	2.291719874
C	5.482395151	5.866304015	1.192080565
C	5.987546475	4.565186380	1.125875412
C	2.539044516	8.370211798	14.428124730
C	2.914444266	7.427279379	13.474385552
C	1.994342283	6.570433245	12.886438014
C	0.646156082	6.631149840	13.243378896
C	0.243359338	7.572763919	14.205927367
C	1.185721459	8.438840509	14.795148914
S	4.457359677	7.122960223	12.844448511
C	3.861808602	5.878097652	11.840890307
N	2.509729662	5.701592351	11.962786617
H	4.143097800	4.227643740	10.819095037
H	3.717009057	9.111151990	6.219098180
H	5.804184273	4.582235688	8.689792836
H	4.048644195	7.858842094	8.276263835
H	3.892278471	9.295097457	3.776498301
H	5.786285289	3.525023215	6.818651978
H	4.487542933	8.322562526	1.606555395
H	6.371054414	2.599338326	4.668705700
H	6.552550587	2.803404449	2.216457870
H	5.352692284	6.431233247	0.272945962
H	6.243768087	4.134317375	0.163011652
H	3.271751933	9.033799053	14.876204126

H	-0.079066765	5.963729886	12.788305577
H	-0.800561893	7.632995177	14.497155102
H	0.864008507	9.162753294	15.536989457

Table S2 – Geometry optimized coordinates of **TyM•••**CN^-.

N	4.505661725	6.711771097	9.847287874
N	5.017432647	6.936733467	11.104594350
C	4.805580796	5.770387575	5.093193677
C	5.523605093	5.216976250	4.007853739
C	3.479751031	6.215895153	4.891520597
C	5.410408978	5.872594296	6.374566549
C	2.758081668	6.747018650	5.963476059
C	6.841257229	4.748712361	4.197829113
C	4.921936047	5.127165047	2.730805058
C	4.670925192	6.443104183	7.447466078
C	5.262804744	6.662374185	8.793184140
C	3.344232300	6.855969493	7.222957452
C	2.893333634	6.119655401	3.620416244
C	6.722259456	5.375829699	6.540898039
C	3.609509202	5.582933529	2.548196441
C	7.426406428	4.827808443	5.465873263
C	7.546994340	4.200811589	3.115898107
C	5.644342979	4.579054895	1.660333734
C	6.949657732	4.119512360	1.855052849
C	1.296491305	6.505275273	14.638129914
C	2.420614979	6.676605447	13.834299152
C	3.658157210	7.014755664	14.363985860
C	3.808011483	7.206156352	15.738346994
C	2.687286152	7.041209973	16.570057471
C	1.437707910	6.689224011	16.022569965
S	2.545961766	6.516587595	12.152862749
C	4.215332892	6.891975238	12.189379147
N	4.673142077	7.135283693	13.453550522

N	3.973980885	3.449027433	9.994173149
C	5.379607248	3.333564823	10.273984036
N	4.536023299	2.697173152	14.968487393
C	4.671676601	3.754202329	16.009091673
C	3.919676048	3.281216298	13.744710865
C	5.882246220	2.153303073	14.634816658
C	3.670608075	1.600247732	15.485347923
H	6.038788851	7.149663811	11.234184241
H	1.736193393	7.090610040	5.825677351
H	6.336479623	6.799803453	8.902588395
H	2.758821181	7.295965704	8.025510076
H	1.874939988	6.461304768	3.454927362
H	7.218469607	5.382735701	7.503234273
H	3.133269317	5.519811971	1.573410121
H	8.435096758	4.457779821	5.630153214
H	8.561854941	3.834297973	3.245342846
H	5.198317232	4.503726856	0.672209586
H	7.502004563	3.694828969	1.022625405
H	0.337574251	6.235512989	14.207227134
H	4.772646071	7.471632982	16.159633588
H	2.786262619	7.182119138	17.641583657
H	0.579483013	6.559942614	16.674344928
H	5.319205508	4.587784192	15.647055375
H	5.129653759	3.341403502	16.939258495
H	3.675167696	4.179350174	16.275996154
H	2.911213387	3.702715311	13.968899977
H	3.800262844	2.506635529	12.950504090
H	4.554233911	4.101080000	13.332844966
H	5.808407310	1.357524681	13.855847594
H	6.367074265	1.709279454	15.536698357
H	6.550854918	2.957189869	14.244326142
H	2.654892002	1.983249800	15.744828906

H	4.112075123	1.143451208	16.403038895
H	3.551102769	0.794297912	14.722654470

Jobs Plot Analysis of TyM with CN^-:

The stoichiometric ratio of the chemoreceptor **TyM** with CN^- successive solutions comprising of 10^{-4} M NBu_4CN and **TyM** were prepared in acetonitrile solvent in such a way that the total concentration of the resulting solution remains constant. The mole fraction of the added analyte CN^- was varied from 0.1 to 0.9. The emission of the chemoreceptor **TyM** at 485 nm has been plotted against the mole fraction of the added analyte. From the Jobs Plot analysis it clearly affirms a 1:1 complexation between the host chemoreceptor **TyM** and the guest analyte (Fig. S15).

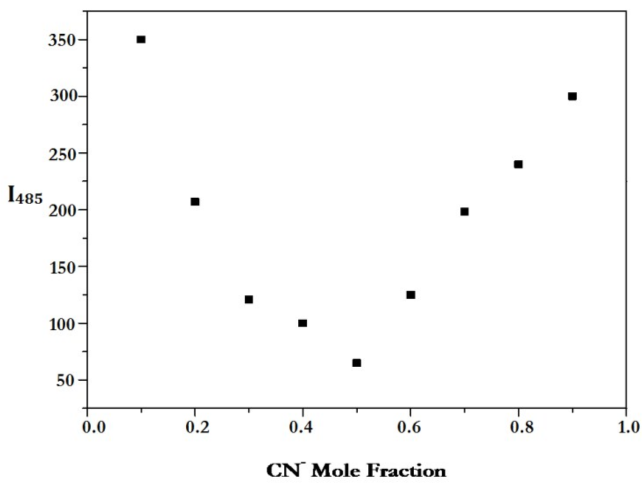


Fig. S15 Job's plot of chemoreceptor **TyM** with CN^- with a total concentration of 10^{-4} M.

Table S3 – Geometry optimized coordinates of **TyM•••**Cu^{2+} (1:1).

N	4.419052915	6.200593960	9.518213073
N	4.678603462	5.756452358	10.794408681
C	4.971261911	6.232795713	4.687927959
C	5.361674832	5.568618460	3.501740668
C	4.306442590	7.476513411	4.597821255
C	5.238721483	5.651129663	5.956730954
C	3.904288304	8.131767205	5.764014069
C	6.010577355	4.317633728	3.573225414
C	5.098128200	6.153277171	2.240851311
C	4.839763545	6.342390462	7.135630997
C	5.136939403	5.829833938	8.500800493

C	4.166104267	7.572598746	7.013016051
C	4.049684896	8.045454320	3.341106695
C	5.870613992	4.387881172	5.996375367
C	4.444333001	7.390602397	2.172498682
C	6.254890573	3.736798351	4.821644608
C	6.394893562	3.665031892	2.392001226
C	5.490919120	5.486414084	1.070684711
C	6.136356472	4.249515531	1.149257989
C	2.192235869	6.696116586	15.350792170
C	2.706759927	6.560640768	14.128136853
C	2.118904664	7.204624968	12.959770222
C	1.025596299	7.963912123	13.079956044
C	0.425673039	8.136662492	14.429353660
C	0.977975815	7.536873689	15.503795001
S	4.134648603	5.631259401	13.592851757
C	3.848997904	6.160140639	11.880179502
N	2.806599186	6.942822037	11.716667918
Cu	1.070191904	7.689836571	8.880458017
H	5.487521391	5.114021484	10.986789795
H	3.389937017	9.087871810	5.711451488
H	5.972792292	5.153353538	8.662760977
H	3.856075046	8.124161177	7.896041151
H	3.540029215	9.002098854	3.261781604
H	6.062292780	3.871528445	6.927908830
H	4.233850832	7.852022695	1.211359492
H	6.740808818	2.766992673	4.891266992
H	6.894724134	2.700811129	2.429507490
H	5.297045815	5.921281941	0.093826968
H	6.436544369	3.738669286	0.239671410
H	2.645559006	6.206186288	16.206272460
H	0.582778760	8.443519912	12.212807350
H	-0.462708496	8.749107085	14.546981167

H	0.534534503	7.666470052	16.485894163

Table S4 – Geometry optimized coordinates of **TyM•••**Cu^{2+} (2:1).

N	2.423819563	8.612024123	11.613226542
N	1.646418895	8.339705806	12.726535839
C	3.488372337	7.745302739	6.996552230
C	3.112737027	7.085338312	5.804058750
C	4.437393079	8.790876368	6.942618847
C	2.907053096	7.369018766	8.235258864
C	4.822204049	9.437098659	8.121122311
C	2.158870776	6.045882558	5.841762282
C	3.682400447	7.473337263	4.569410042
C	3.305169464	8.044082894	9.421423169
C	2.737793869	7.696571755	10.745496356
C	4.272536511	9.056714487	9.344020392
C	4.990781719	9.170626522	5.710654239
C	1.927323396	6.351035108	8.238109795
C	4.615957273	8.517885743	4.533739104
C	1.569310561	5.693250873	7.059568168
C	1.796066980	5.391955470	4.655103820
C	3.301678556	6.812639091	3.391895362
C	2.366654997	5.775083976	3.438437941
C	-0.736548598	11.800446087	15.758984236
C	-0.020451725	11.020759297	14.854082762
C	0.761263896	11.596002321	13.857970358
C	0.861297412	12.980762740	13.734987709
C	0.146782000	13.785267747	14.639346649
C	-0.648974554	13.198216446	15.645000038
S	0.069893740	9.315181912	14.755002150
C	1.124389717	9.398087132	13.416026749
N	1.387805441	10.689425438	13.058103819
N	2.449132341	11.710743421	9.935982877
N	3.509880159	12.600465376	9.968594668

C	-0.449118634	8.780914434	7.432611665
C	-0.706428152	8.147682219	6.195140426
C	-1.111353272	8.327593275	8.595684466
C	0.475544966	9.855024829	7.507490545
C	-0.872986202	8.961365642	9.818544735
C	-0.046796143	8.585037231	5.026704257
C	-1.616623910	7.067647351	6.127176522
C	0.711760134	10.480085365	8.762512692
C	1.659972248	11.609919364	8.907707418
C	0.014833009	10.032632710	9.894284181
C	-2.007263804	7.251009003	8.516342426
C	1.150151235	10.246437362	6.329429127
C	-2.257275306	6.625630259	7.292506070
C	0.881826473	9.627355529	5.106812570
C	-0.313316000	7.956347904	3.801468400
C	-1.864370411	6.446040673	4.894283378
C	-1.217963237	6.893128088	3.738795274
C	7.449180269	12.608674029	13.334305893
C	6.322990442	12.457514395	12.529184954
C	5.367996049	11.480635559	12.790097828
C	5.503536761	10.617871696	13.876414279
C	6.633813778	10.753868543	14.700926539
C	7.601755831	11.743464329	14.430799881
S	5.869367771	13.364180215	11.151413350
C	4.445648283	12.444972503	10.952525325
N	4.331851348	11.474180707	11.906324178
Cu	2.627827363	10.576517273	11.545076009
H	1.407465514	7.354719202	13.003063563
H	5.561597108	10.233392099	8.100193206
H	2.481185355	6.660640863	10.958203600
H	4.624252690	9.543305122	10.244297668
H	5.718819493	9.975722416	5.657535519

H	1.411142874	6.056564814	9.143334189
H	5.059154177	8.830447710	3.592050103
H	0.813096587	4.913671046	7.099572015
H	1.059951794	4.592660878	4.666196059
H	3.726688185	7.099534750	2.433907083
H	2.074378678	5.270329359	2.523041260
H	-1.346222088	11.341857655	16.530954607
H	1.474574896	13.427862336	12.958325353
H	0.206581175	14.866241775	14.561841976
H	-1.197024385	13.830363679	16.336368162
H	3.630627341	13.339499297	9.231790399
H	-1.385728374	8.636692971	10.720159330
H	1.767595600	12.321489049	8.091486356
H	0.139980279	10.535180107	10.843797399
H	-2.519040099	6.892370044	9.405454563
H	1.904390434	11.023367650	6.333533676
H	-2.956146271	5.794244352	7.257099538
H	1.417703099	9.956314725	4.220320429
H	0.188749631	8.278453884	2.893174370
H	-2.558675973	5.613149520	4.823885660
H	-1.412793643	6.406002548	2.788598057
H	8.187875089	13.375182381	13.122705657
H	4.755375107	9.857809363	14.080518767
H	6.762343824	10.092519726	15.551919044
H	8.469671993	11.839015764	15.075436031

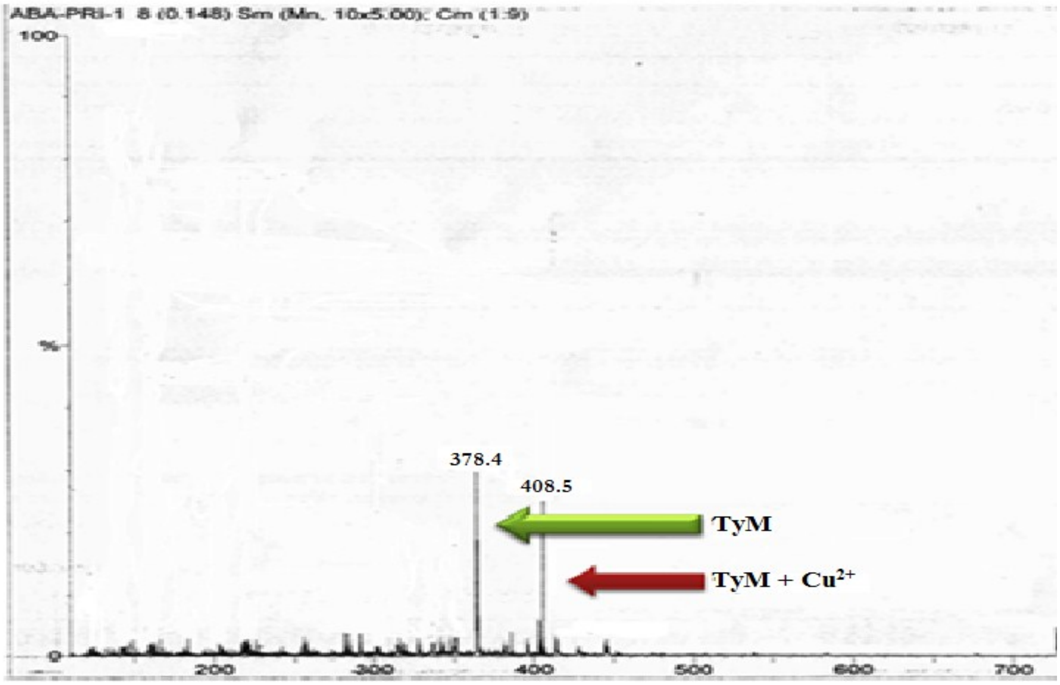


Fig. S16 ESI-MS of **TyM** with Cu^{2+}.

Jobs Plot Analysis of TyM with Cu^{2+}:

In order to assess the stoichiometric ratio of the chemoreceptor **TyM** with Cu^{2+} successive solutions comprising of 5 x 10^{-5} M $Cu(SO_4)_2$ and **TyM** were prepared in acetonitrile solvent in such a way that the total concentration of the resulting solution remains constant. The mole fraction of the added analyte Cu^{2+} was varied from 0.1 to 0.9. The emission of the chemoreceptor **TyM** at 485 nm has been plotted against the mole fraction of the added analyte. From the Jobs Plot analysis it clearly affirms a 2:1 complexation between the host chemoreceptor **TyM** and the guest analyte (Fig. S17).

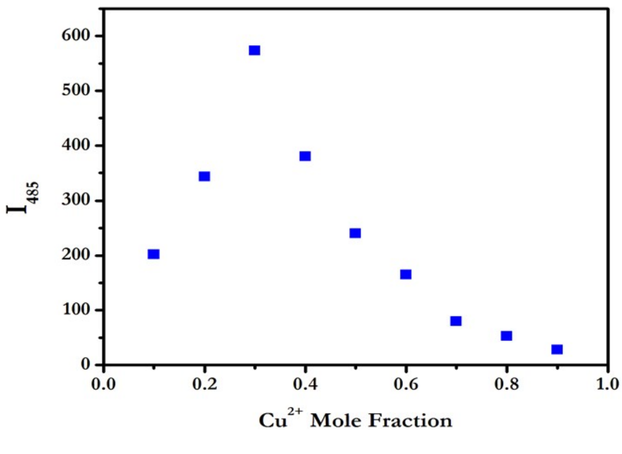


Fig. S17 Job's plot of chemoreceptor **TyM** with Cu^{2+} with a total concentration of 5 × 10^{-5}M.

Cell culture, imaging details:

The bio-imaging system consisted of an inverted fluorescence microscope (Leica DM 1000 LED), digital compact camera (Leica DFC 420C), and an image processor (Leica Application Suite v3.3.0). The microscope was equipped with a mercury 50 Watt lamp.

Preparation of *Monilia Albicans* (prokaryotic cell, diploid fungus) and male microspores of seed plants (*Bohonia Nigalandra*) for intracellular detection of Cu^{2+}:

Two different types of cells *viz. Monilia Albicans* (prokaryotic cell, diploid fungus) and male microspores of seed plants (*Bohonia Nigalandra*). Monilia Albicans cells that have been obtained from exponentially growing culture in the yeast extract glucose broth medium (pH 6.0 and an incubation temperature of 370°C) were washed by suspending them in normal saline and centrifuged at 3000 rpm for approximately 10 minutes. It was then washed thrice with 0.1 M HEPES buffer (pH 7.4). Then the cells were incubated in 50nM Cu^{2+} for 45 minutes. After incubation, the cells were thoroughly washed with HEPES buffer and then again incubated with the developed chemoreceptor **TyM** (10 µM) for another span of 1 hour. The treated cells of the developed chemoreceptor **TyM** were again washed by centrifugation (3000 rpm for 5 minutes) using HEPES buffer. Finally the cells procured in this way were mounted on grease free glass slide and thereby observed under a Leica DM 1000 Fluorescence microscope with UV filter to obtain the bright cyan emission which affirms the intracellular imaging of Cu^{2+} in the presence of the chemoreceptor **TyM.**

Detection limit (DL) has been calculated through the following equation[3]:

DL= CL × ET

CL = Conc. of Chemoreceptor **TyM**; ET = Conc. of titrant at which change is observed.

Detection limit for Cu^{2+}	**Detection limit for CN^-**
$DL = 1 \times 10^{-5} \times 0.004$ equiv $= 4 \times 10^{-8}$ M.	$DL = 1 \times 10^{-5} \times 0.003$ equiv $= 3 \times 10^{-8}$ M

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